Probing the Planetary Population of High-Mass Stars

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Stars with masses greater than ~1.5 times that of the Sun are typically avoided in planet surveys, as these stars' rapid rotation and paucity of spectral lines make follow-up radial velocity observations difficult. Instead, Doppler tomography (where we spectroscopically resolve the distortions in the spectral line shape during the transit of a planet around a rapidly rotating star) and analysis of the orbital phase curve (where we detect the combined effects of Doppler beaming and ellipsoidal variations of the host star and reflected light from the planet) can be used to validate planet candidates around these stars. We propose to use K2 to search for transiting planet candidates around a sample of main sequence A and early F stars in order to expand the sample of known planets around these stars and enable statistical investigations of this largely unexplored population; we will then validate the resulting planet candidates using Doppler tomography and phase curve analysis. Doppler tomography also allows the measurement of the (mis)alignment between the stellar spin and the planetary orbital plane, an important parameter for investigating planetary migration processes. This investigation will not only discover and characterize new planets around massive stars but also provide insight into the planetary population, planet formation, and planet migration around these stars. It will thus address two of the science goals of NASA's Astrophysics program, namely, "Explore the origin and evolution of the galaxies, stars, and planets that make up our universe" and "Discover and study planets around other stars."